City of Edmonds
Development Information

REQUIREMENTS FOR ESTABLISHING DESIGN INFILTRATION RATES

This handout provides a checklist for establishing a design infiltration rate for:

1) Use with City Handout #E72B, *Low Impact Development (LID) Stormwater Best Management Practices (BMPs) Simplified Sizing*. (The siting and design requirements in Handout #E72B remain in place.)

2) Category 1 and Category 2 Small Sites Projects that propose engineered infiltration facilities to meet stormwater management requirements.

Large Site Projects must follow the appropriate methodology in the Department of Ecology's 2005 Stormwater Management Manual for Western Washington (SWMMWW).

This document is intended to guide civil engineers, engineering geologists, geotechnical engineers, and onsite sewage system designers on the City's requirements. It is not intended to be a comprehensive guide. These requirements are not new. They are taken from the City of Edmonds (2010) and Ecology (2005).

City Reviewers will use this checklist to first assess the completeness of the submittal. *Incomplete submittals will be rejected*. Once deemed a complete submittal, the checklist is used by the City Reviewers to expedite assessment of compliance with applicable code provisions.

- Soils Report
  - ☐ Qualified author - licensed onsite sewage system designer, civil engineer, engineering geologist, or geotechnical engineer
  - ☐ Location maps - show proposed facility, soil explorations
  - ☐ Soil boring locations for design - 2 per site at the **exact** location of the proposed infiltration facility.

- Boring / Test Pit Logs
  - ☐ 1 foot below bottom of proposed facility for Category 1 Small sites;
  - ☐ 5 feet below bottom of facility for Category 2 Small sites
  - ☐ Classify each horizon that will be an infiltration receptor per SCS/NRCS (USDA, 1993) methods and nomenclature. USCS classifications (e.g., per ASTM D2487-11) can be converted to SCS/NRCS nomenclature if the percent sand, silt and clay per SCS/NRCS definitions are known and documented.

    Note the definitions of clay, silt and sand by actual particle size are different for the two methods, and must be calculated and adjusted to convert between methods (e.g., sand per USDA is 0.05 to 2.0 mm, per USCS sand is 0.074 to 4.75 mm). See Figure 1.

  - ☐ Show depth of boring/test pit, depth to water, existing ground surface elevation, proposed facility bottom elevation, stratification.
  - ☐ Note evidence of groundwater (e.g., mottling) / depth to seasonal high water table

- Infiltration rates – Choose one: 1) USDA Textural Classification or 2) Modified Pilot Infiltration Test (PIT)[1]. Both are discussed in Section 5.5.2 and in Appendix C of the *Edmonds Stormwater Code Supplement* [*ESCS*] (Edmonds, 2010).

[1] The "D_{10}" method in Section 3.3.6 of Volume III of Ecology (2005) will not be accepted. The City also does not accept any method in the Ecology (2012) at this time.

- Infiltration rate – 1) USDA Textural Classification
  - ☐ Site suitable for USDA Method? i.e., not a large site, limited variability between USDA values.
  - ☐ Grain size analysis per USDA methods? a) Grain size data normalized for fraction <#10 sieve, b) #270 sieve measured or estimated, c) accredited laboratory. If grain size analysis per ASTM D-422 or other method, show conversion calculations to USDA method. See example in Appendix A.
  - ☐ Plotted correctly on USDA triangle [Figure C-1 in the *ESCS*]? visual check
  - ☐ USDA soil type suitable? Sand; Loamy Sand; Sandy Loam; or Loam (partial, see Figure C-1 in the *ESCS*. Note that USCS classifications of Sandy Gravel and Gravelly Sand are also shown in Table C-1 in the *ESCS*.
  - ☐ Apply the appropriate correction factor (CF) using Table C-1 in the *ESCS*..

- Infiltration rate – 2) Modified PIT
  - ☐ Adequate number of PITs in the exact location of the proposed facility?
    - ☐ Infiltration basins: 1 per 5,000 sf infiltrating surface, minimum 2 per basin
    - ☐ Bioretention and permeable pavement: 1 per 5,000 sf contributing area
    - ☐ Infiltration trenches: 1 per 50 feet of trench length
    - ☐ Drywells: 1 per well
  - ☐ Sufficient depth? to bottom of proposed facility
  - ☐ Sufficient size? minimum 2x2 feet
  - ☐ Methods suitable? PIT geometry, measuring devices/methods, splash plate, etc.
  - ☐ Water level/head during test? 3-4 feet, not greater than planned facility water depth
  - ☐ Sufficient duration? water levels and flow stabilized for 1 hour
  - ☐ Falling head data? water levels measured after flow turned off
  - ☐ Falling head rate < constant head rate? Use lower of the two values for the short term rate
  - ☐ Correction factor used? not required for bioretention facilities when imported soil is used
  - ☐ Check correction factor (CF) using Table C-2 (reprinted on page 6 below).
  - ☐ Maximum design rate = 10 in/hr

- Consult the references in the next section of this handout for more information.

REFERENCES

ASTM D422 – 63(2007)e2, 2007. *Standard Test Method for Particle-Size Analysis of Soils*

ASTM D2487 – 11, 2011. *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).*

Ecology, Department of, 2005. *Stormwater Management Manual for Western Washington*.

Ecology, Department of, 2012. *Stormwater Management Manual for Western Washington*, 2014 update.

Edmonds, City of, 2010. *Stormwater Code Supplement to Edmonds Community Development Code Chapter 18.30*, April 20, 2010

Edmonds, City of, #E72 B. *Low Impact Development (LID) Stormwater Best Management Practices (BMPs) Simplified Sizing.*

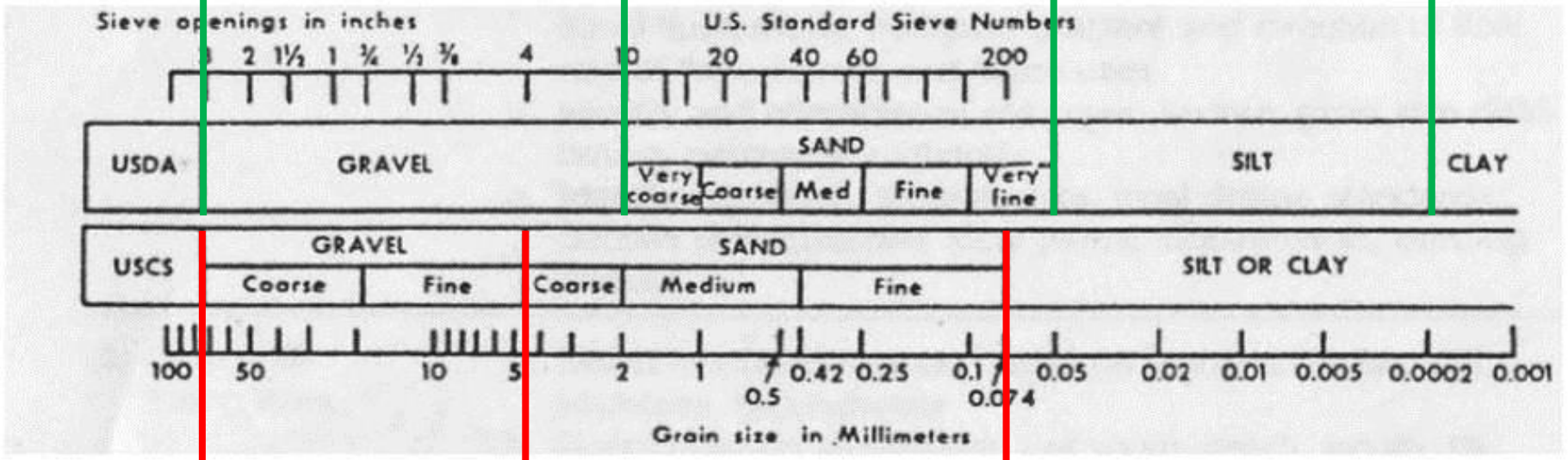
USDA Soil Survey Division Staff, 1993. *Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18*.

Figure 1 - USDA vs. USCS Particle Size

USDA Soil Classification System

75 mm 2.00 0.05 mm 0.002 mm

GRAVEL SAND SILT CLAY

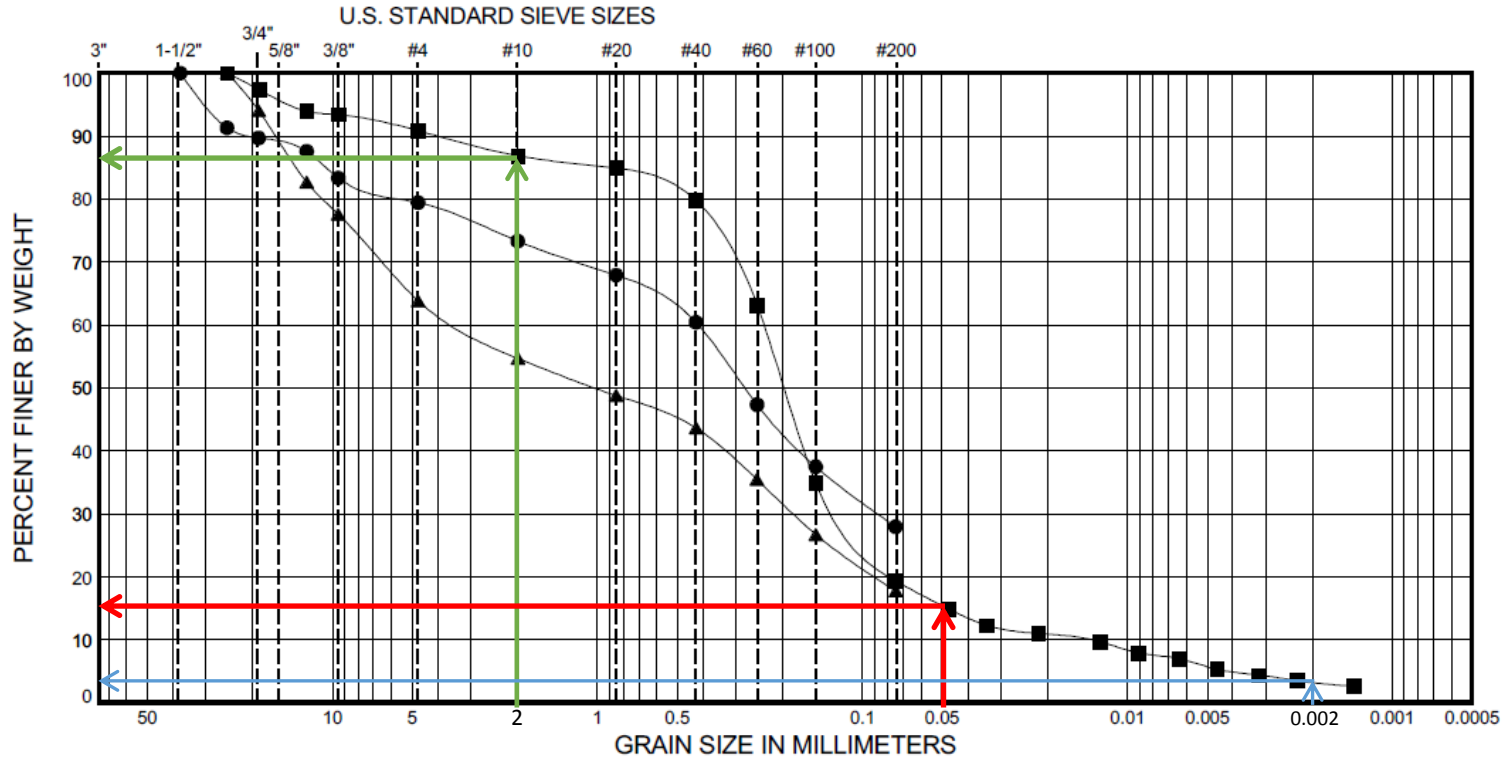


GRAVEL SAND SILT and CLAY

75 mm 4.75 mm 0.074 mm (#200 sieve)

Unified Soil Classification System

APPENDIX A
Typical Grain Size Distribution Curve



SYMBOL	SAMPLE		DEPTH (ft)
●	B-8	8	8.0 - 9.0
■	B-9	8	8.0 - 9.0
▲	B-9	10	10.0 - 12.0

- Reading off the grain size distribution curve on page 4 for Sample **B-9**:

Sieve Size	Percent Passing
2 mm (No.10)	88%
0.05 mm	16%
0.002 mm	2%

- Normalizing for the No.10 Sieve for USDA classification:
  % Sand = 100 – [(16/88) * 100] = 81.8%
  % Silt = [(16/88) – (2/88)] * 100 = 15.9%
  % Clay = 100 - % Sand - % Silt = 2.3%

- Plotting this on the USDA soil triangle results in **<u>Loamy Sand</u>**
- Using Table C-1 in the *ESCS* (shown on page 6 below) for a Loamy Sand sample collect in January, the design infiltration rate is **<u>0.5 inches per hour.</u>**

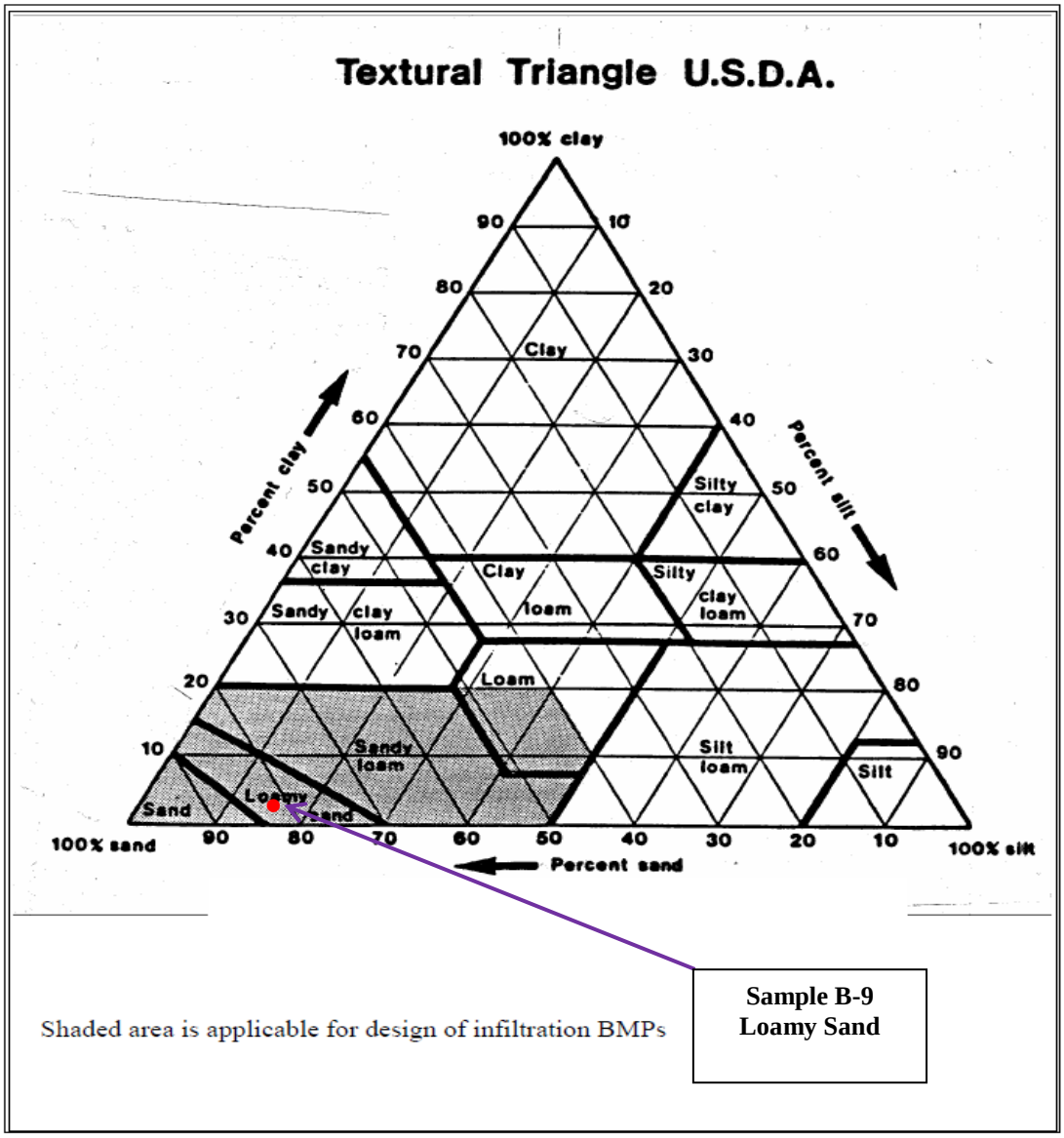


Table C-1: Recommended Infiltration Rates Based on USDA Soil Textural Classification

	*Short-Term Infiltration Rate (in./hr)	Correction Factor CF	Estimated Design (Long-term) Infiltration Rate (in./hr)
Clean sandy gravels and gravelly sands (i.e., 90% of the total soil sample is retained in the #10 sieve)	20	2	10
Sand	8	4	2
Loamy Sand	2	4	0.5
Sandy Loam	1	4	0.25
Loam	0.5	4	0.13

Sample B-9 Loamy Sand

Source: Stormwater Management Manual for Western Washington (Ecology 2005).

* From WEF/ASCE (1998).

Table C-2: Correction Factors to be Used With In-Situ Infiltration Measurements to Estimate Long-Term Design Infiltration Rates

Issue	Partial Correction Factor
Site variability and number of locations tested	CFv = 1.5 to 6
Degree of long-term maintenance to prevent siltation and bio-buildup	CFm = 2 to 6
Degree of influent control to prevent siltation and bio-buildup	CFi = 2 to 6

Total Correction Factor (CF) = $CF_v + CF_m + CF_i$